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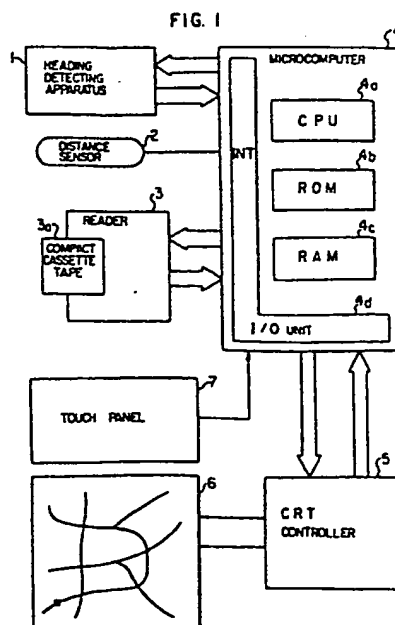
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(54) Navigational apparatus for use in automotive vehicles.

(57) A navigational apparatus for use in automotive vehicles, comprising a distance sensor (2) for detecting a distance travelled by the vehicle and a heading sensor (1) for detecting the direction of travel of the vehicle. In response to the detection signals from the sensors (1, 2) a microcomputer (4) computes the present position of the vehicle and generates a position signal. In accordance with the position signal from the microcomputer (4) and the selection of display selection switches a display tube (6) gives a graphic display of a road map or a character display of a road map data.



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NAVIGATIONAL APPARATUS FOR USE IN AUTOMOTIVE VEHICLES

The present invention relates to a navigational apparatus for use in automotive vehicles for displaying a road map and the present position of a vehicle on a display.

5 In the past, a navigational apparatus has been proposed in which a map sheet printed with a road map is attached to the front face of a CRT (cathode ray tube) display and the present position of a vehicle and its travelled track are displayed on the CRT display thereby indicating to the driver the present position of the vehicle and the route followed by the vehicle on the map.

10 However, this known navigational apparatus is inconvenient in that the driver must select a desired map sheet from a large number of map sheets and manually attach the map sheet in place.

15 While it will be convenient if a road map is displayed on the CRT display, since this is not the manual selection of a road sheet by the driver, there is a disadvantage that it is not easy to confirm the section represented by the road map on the CRT display and it is also difficult to change maps.

According to the present invention there is provided navigational apparatus for use in automotive vehicles comprising:  
distance detecting means for detecting a distance travelled by an  
20 automotive vehicle;  
heading detecting means for detecting a direction of travel of said vehicle;  
computer means responsive to signals from said distance detecting means and said heading detecting means to compute a present position of said vehicle and generate a position signal; and  
25 display means responsive to said position signal from said computer means to display the present position of said vehicle,  
said computer means storing road map data whereby in accordance with said road map data a map signal is generated to cause said display means to graphically display a corresponding road map,  
30 said computer means further storing road map recognition data thereby causing said display means to display a road map recognition data in character display form in place of a graphic road map display.

An embodiment of the present invention provides a navigational apparatus for use in automotive vehicles in which even when a road map is displayed on a display, the driver can easily recognize what section is represented by the road map and also the selection of a map can be directed easily.

An embodiment of the present invention will now be described, by way of an example, with reference to the accompanying drawings, in which:-

Fig. 1 is a block diagram showing the overall construction of an embodiment of the invention;

Fig. 2 is a wiring diagram showing the details of the CRT controller shown in Fig. 1;

Fig. 3 is a schematic diagram showing the touch areas of a touch panel;

Fig. 4 is a schematic diagram showing the data area of a cassette tape;

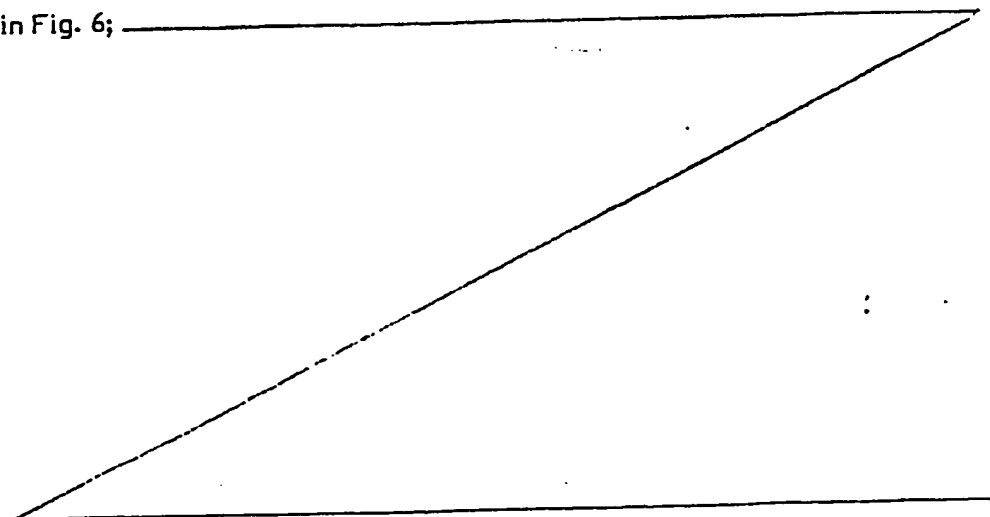
Fig. 5 is a schematic diagram showing a display on a CRT display;

Fig. 6 is an operational flow chart showing the overall computational operations of a main routine of a microcomputer;

Fig. 7 is an operational flow chart showing the computational operations of an interrupt operational routine responsive to a distance pulse from a distance sensor;

Fig. 8 is an operational flow chart showing the detailed computational operations of the mode operational routine shown in Fig. 6;

Fig. 9 is an operational flow chart showing the detailed computational operations of the present position operational routine shown in Fig. 6;



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1            Fig. 10 is a flow chart showing another  
embodiment of the mode operational routine; and

            Figs. 11 and 12 are schematic diagrams showing  
a CRT display according to another embodiment of the  
5    invention.

            The present invention will now be described in  
greater detail with reference to the illustrated embodi-  
ment.

            Referring to Fig. 1, numeral 1 designates a  
10   heading detecting apparatus for detecting the heading  
of a vehicle, comprising a heading sensor for sensing X  
and Y components of the earth's magnetic field corres-  
ponding to the vehicle's heading and an A/D converter  
for converting the signals from the heading sensor to  
15   digital signals thereby generating X-component and  
Y-component digital signals corresponding to the vehicle's  
heading. The X-component indicates a component along  
with the direction of travelling of the vehicle. The  
Y-component indicates a component along with the direc-  
20   tion of travelling of the vehicle. A distance sensor 2  
generates a distance pulse for every unit distance  
(e.g., about 39.2 cm) travelled by the vehicle. A  
reader 3 comprises a tape recorder whereby by setting a  
compact cassette tape 3a storing the road map data of a  
25   plurality of section (including the absolute coordinates  
data of the upper right points of the respective road  
maps), the map data of any selected one of the sections  
are searched and read out.

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1           A microcomputer 4 performs software digital  
computational operations in accordance with a predeter-  
mined control program and it comprises a CPU 4a, an ROM  
4b, an RAM 4c and an I/O unit 4d. When the micro-  
5 computer 4 comes into operation in response to a stablized  
voltage supplied from a stabilized power supply circuit  
(not shown) which generates a stabilized voltage of  
5 V from the voltage supplied from the vehicle battery  
(not shown), the X-component and Y-component digital  
10 signals from the heading detecting apparatus 1, the  
distance pulse from the distance sensor 2 and the output  
signal from the reader 3 are received and the necessary  
computational operations are performed generating display  
signals for displaying the road map of a selected sec-  
15 tion, travel path data, etc. The RAM 4c is always  
backed up with the power supply from the vehicle battery  
irrespective of the ON and OFF of the automotive vehicle  
key switch.

A cathode ray tube (CRT) controller 5 is  
20 responsive to the display signals from the microcomputer  
4 to separately store the road map data of the selected  
section, the travel path data and a character data and  
generate a video signal and synchronizing signals for  
displaying the stored road map data and travel path data  
25 or the character data on a display 6. The CRT display 6 is  
responsive to the video signal and the synchronizing  
signals from the CRT controller 5 to display the road map  
of the selected section and the travel path or the

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1 character on the display. A touch panel switch 7 is  
attached onto the screen of the CRT display 6 whereby  
when a selected one of its 12-division touch areas provided  
on the touch panel is operated by touching, the corres-  
5 ponding serial signal is generated.

Next, the CRT controller 5 will be described  
in greater detail with reference to the detailed wiring  
diagram shown in Fig. 2. Numeral 11 designates an  
oscillator circuit for generating an oscillation signal  
10 of 12.096 MHz, 12 a dot counter for dividing the  
frequency of the oscillation signal from the oscillator  
circuit 11 to generate 6.048 MHz dot timing clocks and  
756 KHz character timing clocks, and 13 a display control-  
ler responsive to the command from the microcomputer 4  
15 and the character timing clocks from the dot counter  
12 to generate horizontal and vertical synchronizing  
signals, display timing signals, a refresh memory address  
signal and a raster address signal. Numeral 14 design-  
ates a hold signal generating circuit responsive to the  
20 horizontal and vertical synchronizing signals from the  
display controller 13 to generate at the HOLD terminal  
of the microcomputer 4 a hold signal to hold the micro-  
computer 4 during the display period. Numeral 15  
designates a multiplexer responsive to a hold acknowledge  
25 (HOLDA) signal from the microcomputer 4 to switch the  
address signal from the microcomputer 4 and the refresh  
memory address signal and the raster address signal from  
the display controller 13. Numerals 16, 17 and 18

1 designate bus drivers with 3-state outputs for changing  
the direction of data flow between the microcomputer 4  
and display memories, and 19 a character memory for  
storing display data such as an ASCII code from the  
5 microcomputer 4 and also responsive to the refresh  
memory signal to generate its content as an address.  
Numeral 20 designates a character generator responsive  
to the display address from the character memory 19 and  
the raster address signal from the display controller  
10 13 to generate a display pattern. Numeral 21 designates  
a first graphic memory for storing a road map data from  
the microcomputer 4, and 22 a second graphic memory for  
storing a travel path data (a travel track data and a  
present position data) from the microcomputer 4.  
15 Numerals 23, 24 and 25 designate parallel-to-serial  
(P + S) converters for respectively converting the parallel  
signals from the character generator 20 and the first  
and second graphic generators 21 and 22 to serial data  
in response to the dot timing clocks from the dot counter  
20 12, and 26 a video controller responsive to an image  
selection signal from the microcomputer 4 to switch the  
reception of signals between the P + S converter 23 and  
the P + S converters 24 and 25 and generate a video signal  
in response to the display timing signal from the display  
25 controller 13, thereby selecting a graphic image or a  
character image. Numeral 27 designates an exclusive OR  
circuit for generating synchronizing signals in response  
to the horizontal and vertical synchronizing signals

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1 from the display controller 13. The character memory 19  
and the first and second graphic memories 21 and 22 are  
always backed up by the power supply from the vehicle  
battery.

5 More specifically, the CRT controller 5 is  
responsive to the data sent from the microcomputer 4 to  
always store the character data in the character memory  
19, the road map data in the first graphic memory 21 and  
the travel track and present position display data in  
10 the second graphic memory 22, and the controller 5  
is also responsive to the image selection signal from  
the microcomputer 4 such that a graphic image (for  
displaying the travel track and the present position on  
the road map) or a character image (for displaying .  
15 characters or the like to designate a given road map)  
is selected and a video signal and synchronizing signals  
for displaying the selected picture on the CRT are  
applied to the CRT display 6.

As shown in Fig. 3, the touch panel switch  
20 7 is divided into 12 touch areas 31 to 42 and it comprises  
two sheets of glass and a transparent conductive coating  
applied in matrix form on each of the glass sheets.  
Thus, when selected one of the touch areas is depressed,  
the matrix transparent conductive coatings contact  
25 thereby detecting the selected touch area by the deforma-  
tion of the glass sheet and a touch signal generating  
circuit (not shown) generates a serial signal (comprising  
a start signal and a touch data signal) corresponding to



1 the detected touch area. Note that the touch signal  
generating circuit generates the touch data as a serial  
signal at intervals of 40 msec.

Fig. 4 shows a data area corresponding to one of  
5 the sections on the cassette tape 3a, in which A designates  
a header portion storing the absolute coordinates (the co-  
ordinates with respect to the north pole) data corres-  
ponding to the upper right point of the road map for the  
section, B a road map data storage portion storing the  
10 map data of the section and X blank portions. As a  
result, by causing the reader 3 to read the portions A  
and B of any selected section, the map data and the  
absolute coordinates data of the selected section can be  
supplied to the microcomputer 4.

15 With the construction described above, the  
operation of the navigational apparatus according to the invention  
will now be described.

When the key switch of the vehicle having the  
component parts 1 to 7 shown in Fig. 1 is closed at the  
20 start of the operation, the respective electric units  
are supplied with the power from the vehicle battery and  
are brought into operation. Then, the microcomputer 4  
is supplied with the stabilized voltage of 5 V from the  
stabilized power supply circuit and it comes into  
25 operation starting its processing by a start step 100  
in Fig. 6. Then, the processing proceeds to an initiali-  
zation routine 200 so that the registers, counters,  
latches, etc., in the microcomputer 4 are set to the

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1 required initial states for commencing the computational  
operations. This initialization step includes the  
operation of setting a cursor move enable flag which  
will be described later. After the initialization step  
5 200, a mode operational routine 300 and a present position  
operational routine 400 are executed repeatedly  
at intervals of about several tens msec.

More specifically, the mode operational routine  
300 performs operations so that either a road map mode  
10 or a character mode is selected thus displaying the  
contents corresponding to the selected mode on the CRT  
display and also the movement of a present position  
indicating cursor is enabled when the road map mode is  
selected or the designation of the road map of a given  
15 section is enabled when the character mode is selected.  
Then, the processing proceeds to the present position  
operational routine 400. The present position operational  
routine 400 performs operations such that the contents  
of the present position data and the travel track data  
20 in the second graphic memory 22 of the CRT controller 5  
are modified for the X and Y components, respectively,  
in response to every change of travel of  $\pm 50$  m. Then,  
the processing returns to the mode operational routine 300.  
Thereafter, the processing of the main routine from the  
25 mode operational routine 300 to the present position  
operational routine 400 are executed repeatedly at  
intervals of several tens msec.

With the above-described processing of the main

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1 routine being executed repeatedly, when a distance pulse  
is applied from the distance sensor 2 to an interrupt  
(INT) terminal of the microcomputer 4, the microcomputer  
4 temporarily interrupts the processing of the main  
5 routine and executes the interrupt processing routine  
shown in Fig. 7. More specifically, an interrupt start  
step 501 starts the processing of this routine so that  
an integration step 502 integrates a unit distance data  
(corresponding to about 39.2 cm) and updates a distance  
10 data D stored in the RAM 4c and then the processing  
proceeds to a distance decision step 503 which in turn  
determines whether the distance data D has reached  
6.25 m. If the distance data D is less than 6.25 m, the  
decision becomes NO and the processing proceeds to a  
15 return step 510. If the distance data D has reached  
6.25 m, the decision becomes YES and the processing  
proceeds to a heading signal inputting step 504. The  
heading signal inputting step 504 inputs the digital  
X-component and Y-component signals  $X_a$  and  $Y_a$  (the east  
20 and north are positive directions and the west and  
south are negative directions) from the heading  
detecting apparatus 1 and then the processing proceeds to  
an average heading computing step 505 which in turn  
obtains average heading data X and Y from the preceding  
25 heading data  $X_0$  and  $Y_0$  (the preceding heading data  
before the travelling of 6.25 m) and the current heading  
data  $X_a$  and  $Y_a$ . Then, the processing proceeds to a  
distance component computing step 506 which obtains

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1 an X-direction distance component  $D_x$  as  $6.25X / \sqrt{X^2 + Y^2}$   
and a Y-direction distance component  $D_y$  as  $6.25Y / \sqrt{X^2 + Y^2}$   
( $X / \sqrt{X^2 + Y^2}$  corresponds to  $\cos \theta$  and  $Y / \sqrt{X^2 + Y^2}$   
corresponds to  $\sin \theta$  with respect to the angle  $\theta$   
5 measured counterclockwise from the direction of the east).  
Then, the processing proceeds to a storage step 507  
which stores the current heading data  $X_a$  and  $Y_a$  as  $X_0$   
and  $Y_0$  for the next processing, and the processing pro-  
ceeds to a distance data reset step 508 which resets  
10 the distance data  $D$  to zero. The processing then  
proceeds to a distance flag set step 509 which sets a  
distance flag and then the processing proceeds to the  
return step 510 thus returning to the main routine  
temporarily interrupted previously. In other words,  
15 the interrupt operational routine performs the opera-  
tions so that the distance data  $D$  is updated by integra-  
tion each time the unit distance is travelled and upon  
the distance data  $D$  reaching 6.25 m the corresponding  
X-direction and Y-direction distance components  $D_x$  and  
20  $D_y$  are computed thereby setting the distance flag.

Next, the detailed computational operations of  
the mode operational routine 300 in the main routine  
will be described. The processing of the mode operational  
routine 300 is started by a touch data inputting step  
25 301 of Fig. 8 so that the touch data from the touch  
panel 7 is inputted and stored in the RAM 4c. Then,  
the processing proceeds to a map mode decision step 302  
so that whether the contents of the mode area in the

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1 RAM 4c represent the map mode. If the map mode is  
determined, the decision becomes YES so that the processing  
proceeds to a mode change decision step 303 and whether  
the touch data stored in the RAM 4c is one indicative  
5 of a mode change (i.e., the data resulting from the  
depression of the touch area 34 in Fig. 3) is determined.  
If the touch data is the mode change indicative data,  
the processing proceeds to a character mode setting  
step 304 which sets the contents of the mode area to a  
10 character mode and then the processing proceeds to a  
character selection signal outputting step 305 so  
that a character selection signal is applied to the video  
controller 26 of the CRT controller 5 to provide a  
character image on the CRT display 6, thus completing  
15 one cycle of the processing of the mode operational  
routine 300.

On the other hand, if the touch data is not  
the mode change indicative data, that is, if it is the  
data resulting from the depression of any touch area  
20 other than the touch area 34 in Fig. 3 or the data  
obtained when none of the touch area is depressed  
(e.g., a data FF), the decision of the mode change  
decision step 303 becomes NO and the processing  
proceeds to a cursor move decision step 306. The cursor  
25 move decision step 306 determines whether the touch  
data is the one (or a cursor move data) resulting from  
the depression of any one of the touch areas 32, 33, 35,  
38, 40 and 41. If the touch data is not the cursor

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1 movement data, the decision becomes NO and thus one  
cycle of the processing of the mode operational routine  
300 is completed. If the touch data is the cursor  
movement data, the decision becomes YES and the  
5 processing proceeds to a cursor movement computing step  
307. The cursor movement computing step 307 is respon-  
sive to the touch data so that if the touch data is one  
resulting from the depression of the touch area 32 or  
33, the contents of the second graphic memory 22 of the  
10 CRT controlelr 5 are modified in a manner that the  
cursor indicating the vehicle's present position  
displayed on the CRT display 6 is moved a predetermined  
distance in the direction of the north. In like manner,  
the necessary operations are performed and the contents  
15 of the second graphic memory 22 are modified in such a  
manner that the cursor is moved the predetermined  
distance toward the west when the touch data is one  
resulting from the depression of the touch area 35,  
the cursor is moved similarly toward the south when  
20 the touch data is one resulting from the depression  
of the touch area 40 or 41 or the cursor is moved  
similarly toward the east when the touch data is one  
resulting from the depression of the touch area 38,  
thereby completing one cycle of the mode operational  
25 routine 300.

On the other hand, if the decision of the map  
mode decision step 302 is NO, the processing proceeds  
to a mode change decision step 308 so that whether a

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1 mode change is required is determined by the similar  
operation as the mode change decision step 303. If a  
mode change is required so that the decision becomes  
YES, the processing proceeds to a map mode setting step  
5 309 and the contents of the mode area in the RAM 4c are  
set to the map mode. The processing then proceeds to  
a data modification step 310 which modifies the travel  
path data in the second graphic memory 22 of the CRT  
controller 5. In this case, the reader 3 is first  
10 controlled to search the designated section so that  
coordinates modification values are computed from the  
absolute coordinates (stored in the header portion A  
shown in Fig. 4) of the searched map and the preceding  
map absolute coordinates data and the travel track and  
15 present position data in the second graphic memory 22  
are modified and slid in accordance with the computed  
values. Then, the processing proceeds to a map data  
read step 311 so that a map data is inputted from the  
cassette tape 3a through the reader 3 and then the map  
20 data is outputted to the first graphic memory 21. Then,  
the processing proceeds to a map selection signal  
outputting step 312 so that a map selection signal is  
applied to the video controller 26 thereby causing the  
CRT display 6 to display a map graphic image. Thus,  
25 one cycle of the processing of the mode operational routine  
300 is completed. In other words, when changing from  
the character image to a map graphic image which is  
different from the preceding one, the above-mentioned

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1 operations are performed so that the current map data  
is stored in the first graphic memory 21 and also the  
contents of the second graphic memory 22 are modified so  
as to modify the travel track and the present position  
5 indicative cursor to the vehicle's present position  
corresponding to the map. In this way, when the map  
displayed on the CRT display 6 is replaced with another  
map, the travel track and the present position can be  
displayed on the map portions corresponding to the  
10 replaced map.

On the contrary, if the decision of the  
mode change decision step 308 is NO, the processing  
proceeds to a character computing step 313. The  
proceeding of the processing to the character computing  
15 step 313 indicates the condition where the character  
mode has been set and the character selection signal  
has been applied to the video controller 26 and therefore  
the CRT display 6 is displaying a character image such as  
shown in Fig. 5. The figure 02, 4 and 68 shown in the  
20 central portion of the character image are respectively  
district, division and section designating figures and  
the character computing step 313 perform operations so  
that each of the figures is updated by increasing it by  
1 at a time by an increment switch 51, is updated by  
25 decreasing it by 1 at a time by a decrement switch 52,  
is set by a set switch 53 and is reset by a reset switch  
54. The data of these district, division and section  
figures are stored in the RAM 4c. The switches 51, 52,



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1 53 and 54 are respectively associated with the touch  
areas 39, 40, 41 and 42 in Fig. 3.

In other words, the mode operational routine 300  
shown in Fig. 8 performs the following operations (1)  
5 to (4) in accordance with the touch data from the touch  
panel 7 and the contents of the mode area in the RAM 4c.

(1) In the map mode without a mode change command,  
if a cursor move command is generated, the operations  
for moving the cursor are performed. If there is no  
10 cursor move command, the map display is maintained as  
such.

(2) In the map mode, if a mode change command  
is generated, the map mode is changed to the character  
mode and also a character image is provided on the CRT  
15 display 6.

(3) In the character mode without a mode change  
command, any map change command to a character image  
such as shown in Fig. 5 is acceptable.

(4) In the character mode, if a mode change command  
20 is generated, the character mode is changed to the map  
mode and also a map graphic image is provided on the CRT  
display 6. Simultaneously, the travel track and the  
present position are modified and displayed.

Next, the detailed computational operations  
25 of the present position operational routine 400 of the  
main routine will be described. With the present position  
operational routine 400, its processing is started by  
a distance flag decision step 401 of Fig. 9 and it is

1 determined whether the distance flag has been set by the  
interrupt processing routine of Fig. 7. If the distance  
flag has not been set, the decision becomes NO and one  
cycle of the processing of the present position opera-  
5 tional routine 400 is completed. If the distance flag  
has been set, the decision becomes YES and the processing  
proceeds to an X distance correction step 402. The X  
distance correction step 402 corrects the X distance data  
DX by the X distance component Dx obtained by the inter-  
10 rupt processing routine as  $DX = DX + Dx$ , and a Y distance  
correction step 403 similarly performs a correction  
computation of  $DY = DY + Dy$ , and then the processing  
proceeds to a first X distance decision step 404 which  
in turn determines whether the value of the X distance  
15 data DX is greater than 50 m. In this case, if the  
value of the X distance data DX is greater than 50 m,  
the decision becomes YES so that the processing proceeds  
to an X distance subtraction step 405 and a value of 50 m  
is subtracted from the X distance data DX. Then, the  
20 processing proceeds to a display move step 406 so that  
the present position data in the second graphic memory  
22 is moved in the positive direction (toward the east)  
by 50 m and also the travel track data is moved corres-  
pondingly.

25 If the decision of the X distance decision  
step 404 is NO, the processing proceeds to a second X  
distance decision step 407 which in turn determines  
whether the value of the X distance data DX is less

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1 than -50 m. If the value of the X distance data DX is  
less than -50 m, the decision becomes YES and the  
processing proceeds to an X distance addition step 408  
thus adding the value of 50 m to the X distance data DX.  
5 Then, the processing proceeds to a display move step 409  
so that the present position data in the second graphic  
memory 22 is moved in the negative direction (toward the  
west) by 50 m and also the travel track data is moved  
correspondingly.

10 Then, when the decision of the second X distance  
decision step 407 is NO or after the display move step  
406 or 409, the processing proceeds to a Y-componett  
display move processing routine 410 so that the similar  
decision and computational operations as the steps 404  
15 through 409 are performed on the Y distance data DY  
computed by the Y distance correction step 403. (When  
the value of the Y distance data DY becomes greater  
than 50 m in either the positive or negative direction,  
the present position data and the travel track data in the  
20 second graphic memory 22 are moved by 50 m in the  
corresponding direction.) Then, the processing proceeds  
to the next distance flag reset step 411 and the distance  
flag is reset.

In other words, in accordance with the present  
25 position operational routine 400 shown in Fig. 9, the  
present position data and the travel track data in the  
second graphic memory 22 are modified irrespective of  
the image displayed on the CRT display 6.

1           As a result, in accordance with the repeated  
processing of the main routine by the mode operational  
routine 300 and the position position operational routine  
400 and the interrupt processing routine of Fig. 7, the  
5 present position data and the travel track data in the  
second graphic memory 22 are successively modified and  
also the selection of an image on the CRT display 6  
is accomplished in such a manner that a map graphic  
image (including the display of the present position and  
10 travel track) is displayed in the map mode and the map  
selection character image shown in Fig. 5 is displayed in  
the character mode.

The present invention is not intended to be  
limited to the above-described embodiment. For instance,  
15 the routine of Fig. 8 may be replaced with the routine  
of Fig. 10 (steps 506 to 515 are added) so as to disable  
any manual movement of the cursor temporarily and thereby  
to prevent any erroneous movement of the cursor. This  
processing will now be described with reference to a  
20 step 303, et seq.

If the inputted touch data is not a mode change  
indicative data, that is, if it is the data resulting  
from the depression of any touch area other than the  
touch area 34 in Fig. 3 or the data (e.g., the data FF)  
25 resulting from the depression of none of the touch areas,  
the decision of the mode change decision step 303 becomes  
NO and the processing proceeds to a cursor move enable  
decision step 506. The step 506 determines whether the

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1 touch data is the one (the data resulting from the  
touching of the touch area 39 in Fig. 3) which enables  
the movement of the cursor. If the decision is YES,  
the processing proceeds to a 1 second lapse decision  
5 step 507 which determines whether the touch data is  
stored in the RAM 4c in excess of 1 second (or the  
touch area 39 is touched continuously more than 1 second).  
If the decision is NO, one cycle of the processing of  
this mode operational routine 300' is completed.

10 On the other hand, if the decision of the 1  
second lapse decision step 507 is YES, the processing  
proceeds to a cursor move enable flag setting step 508  
so that the cursor move enable flag in the RAM 4c is  
set. Then, the processing proceeds to an ENABLE display  
15 step 509 and the necessary display data for displaying  
the word ENABLE on the CRT display 6 as shown in Fig. 11  
is stored in the second graphic memory 22, thereby  
completing one cycle of the processing of the mode  
operational routine 300'.

20 If the decision of the cursor move enable  
decision step 506 is NO, the processing proceeds to a  
cursor move disable decision step 510 which determines  
whether the touch data is the one (the data resulting  
from the touching of the touch area 42 in Fig. 3) which  
25 indicates disabling of the cursor movement. If the  
decision is YES, the processing proceeds to a cursor  
move enable flag reset step 511 and the cursor move  
enable flag in the RAM 4c is reset. Then, the processing

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1 proceeds to a DISABLE display step 512 and the necessary  
display data for displaying the word DISABLE on the CRT  
display 6 as shown in Fig. 12 is stored in the second  
graphic memory 22, thereby completing one cycle of the  
5 processing of the mode operational routine 300'.

On the other hand, if the decision of the  
cursor move disable decision step 510 is NO, the processing  
proceeds to a cursor move enable flag decision step 513.  
The step 513 determines whether the cursor move enable  
10 flag in the RAM 4c has been set. If the flag has not been  
set, one cycle of the processing of the mode operational  
routine 300' is completed through a DISABLE display  
step 514.

If the decision of the cursor move enable flag  
15 decision step 513 is YES (or the cursor move enable  
decision flag in the RAM 4c has been set), the processing  
proceeds to a cursor move decision step 306 via an  
ENABLE display step 515. The cursor move decision step  
306 determines whether the touch data is the one (or a  
20 cursor move data) resulting from the depression of any  
one of the touch areas 32, 33, 35, 38, 40 and 41. If the  
touch data is not the cursor move data, the decision  
becomes NO and one cycle of the processing of the mode  
operational routine 300' is completed. If the touch  
25 data is the cursor move data, the decision becomes YES  
and thus the processing proceeds to a cursor move  
computing step 307. The other steps 301, 302 and 304 to  
312 are the same as in the routine of Fig. 8.

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1           In other words, the mode operational routine  
300' shown in Fig. 10 performs the following operations  
(1) and (2) in accordance with the touch data from the  
touch panel 7 and the contents of the mode area and the  
5 cursor move enable flag in the RAM 4c.

(1)           In the map mode without a mode change command,  
if the touch area 39 is touched more than 1 second, the  
cursor move enable flag is set so that the movement of  
the cursor is enabled and the word ENABLE is displayed  
10 on the CRT display 6. Then, if the touch area 42 is  
touched, the cursor move enable flag is reset so that  
the movement of the cursor is disabled and the word  
DISABLE is displayed on the CRT display 6.

(2)           In the map mode without a mode change command  
15 or when the cursor move enable flag has been set (or  
the CRT display 6 is displaying the word ENABLE), the  
necessary operations for moving the cursor are performed  
if a cursor move command is generated and the map display  
is maintained as such if no cursor move command is  
20 generated.

While, in the embodiment described above, the  
movement of the cursor is enabled when the touch area 39  
is touched more than 1 second and the movement of the  
cursor is disabled when the touch area 42 is touched, it  
25 is possible to arrange so that each time any given one  
of the touch areas is depressed, the cursor move enable  
condition is changed to the cursor move disable condition  
or vice versa. Further, the switch means for effecting

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1 the transition between the cursor move enable state and the cursor move disable state may be provided in the form of external switch means instead of being incorporated in the touch panel 7.

5 Still further, the words ENABLE and DISABLE may be replaced by another words and also they may be displayed at any place other than the CRT display 6 by for example turning on and off LEDs.

Still further, while the movement of the cursor  
10 is disabled through the touch operation of the touch panel 7, this may be effected by means of a voice command.

Still further, while the CRT display 6 is used as display means, a liquid crystal display, EL display or the like may be used.



CLAIMS

1. A navigational apparatus for use in automotive vehicles comprising:  
distance detecting means (2) for detecting a distance travelled by an automotive vehicle;  
heading detecting means (1) for detecting a direction of travel of said vehicle;  
computer means (4) responsive to signals from said distance detecting means (2) and said heading detecting means (1) to compute a present position of said vehicle and generate a position signal; and  
display means (6) responsive to said position signal from said computer means (4) to display the present position of said vehicle,  
said computer means (4) storing road map data whereby in accordance with said road map data a map signal is generated to cause said display means (6) to graphically display a corresponding road map,  
said computer means (4) further storing road map recognition data thereby causing said display means (6) to display a road map recognition data in character display form in place of a graphic road map display.
2. Apparatus as claimed in claim 1, further characterized in that said road map recognition data include "district", "division" and "section" indicative data.
3. Apparatus as claimed in claim 1 or claim 2, further characterized in that said computer means (4) detects an operation of a selected one of a plurality of switches (31-42) to apply to said display means (6) a signal to graphically display a road map or another signal to display a road map recognition data in character display form.
4. Apparatus as claimed in claim 3, further characterized in that said switches (31-42) comprise panel switches provided on a front part of a display screen of said display means (6) such that display contents on said display screen are visually observable.
5. Apparatus as claimed in any preceding claim, further characterized in that in a map mode with no change of said map mode being required, said

computer means (4) performs computational operations for moving a cursor when a cursor move command is present and said computer means (4) maintains a map display when said cursor move command is not present.

6. Apparatus as claimed in any preceding claim, further characterized in that when a mode change command is generated in a map mode, said computer means (4) changes said map mode to a character mode and causes said display means (6) to provide a character image.

7. Apparatus as claimed in any preceding claim, further characterized in that in a character mode with no change of said character mode being required, said computer means (4) enables any change of a map with respect to a specific character image.

8. Apparatus as claimed in any preceding claim, further characterized in that when a mode change command is generated in a character mode, said computer means (4) changes said character mode to a map mode and causes said display means (6) to give a graphic image of a map and also to modify and display a travel track and a present position of said vehicle.

9. Apparatus as claimed in claim 3 or claim 4, further characterized in that when a first one of said switches (31-42) is touched more than 1 second in a map mode with no change of said map mode being required, said computer means (4) establishes a cursor move enable state to enable movement of a cursor and cause said display means (6) to display a word ENABLE, and wherein when second one of said switches is touched, said computer means (4) releases said cursor move enable state to disable movement of said cursor and causes said display means (6) to display a word DISABLE.

10. Apparatus as claimed in claim 3 or claim 4, further characterized in that in a map mode with no change of said map mode being required and a cursor move enable state being established (or a word ENABLE being displayed on said display means (6)), said computer means (4) performs computational operations for moving a cursor when a cursor move command is present, and said computer means (4) maintains a map display when said cursor move command is not present.

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FIG. 1

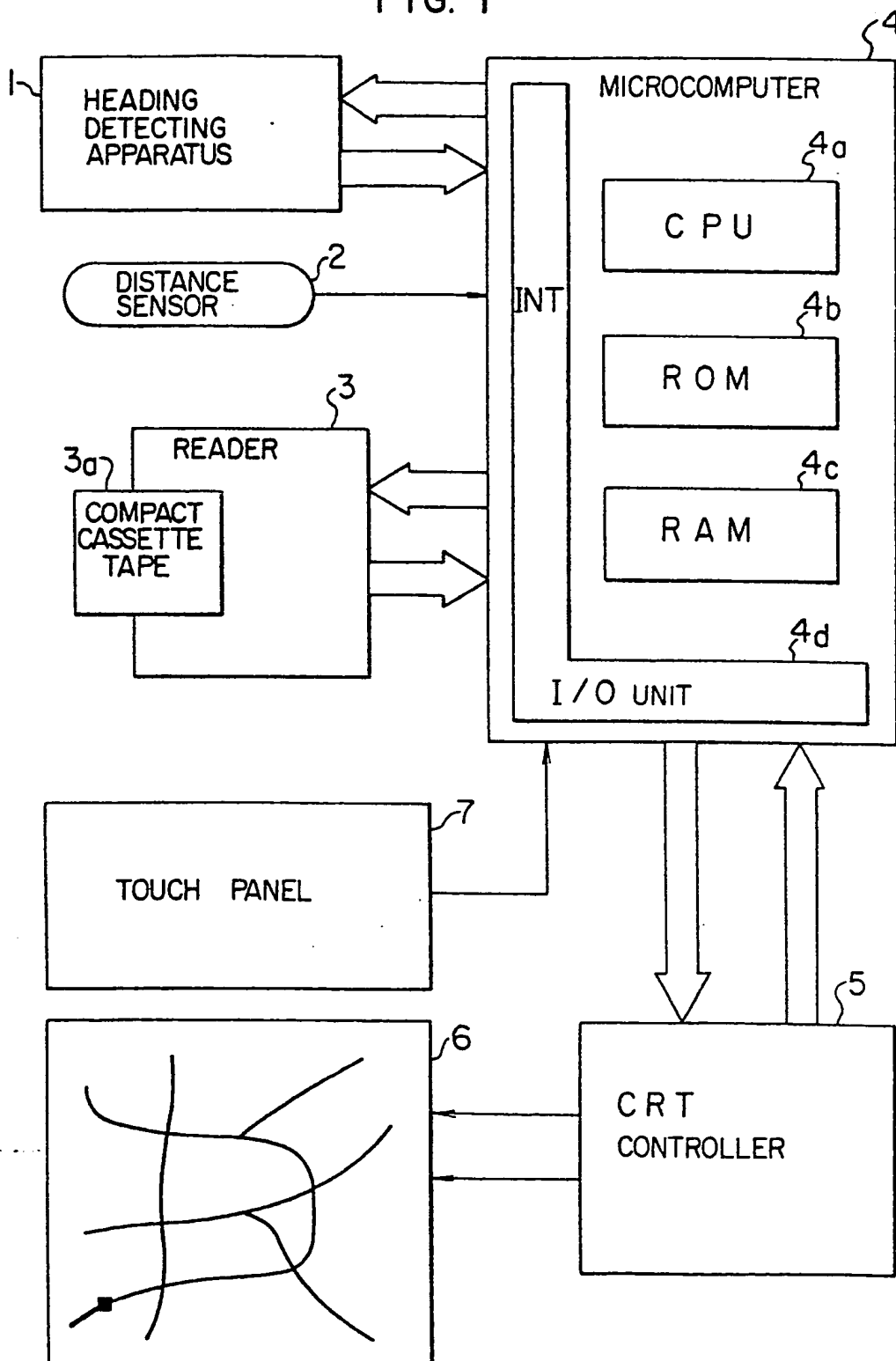
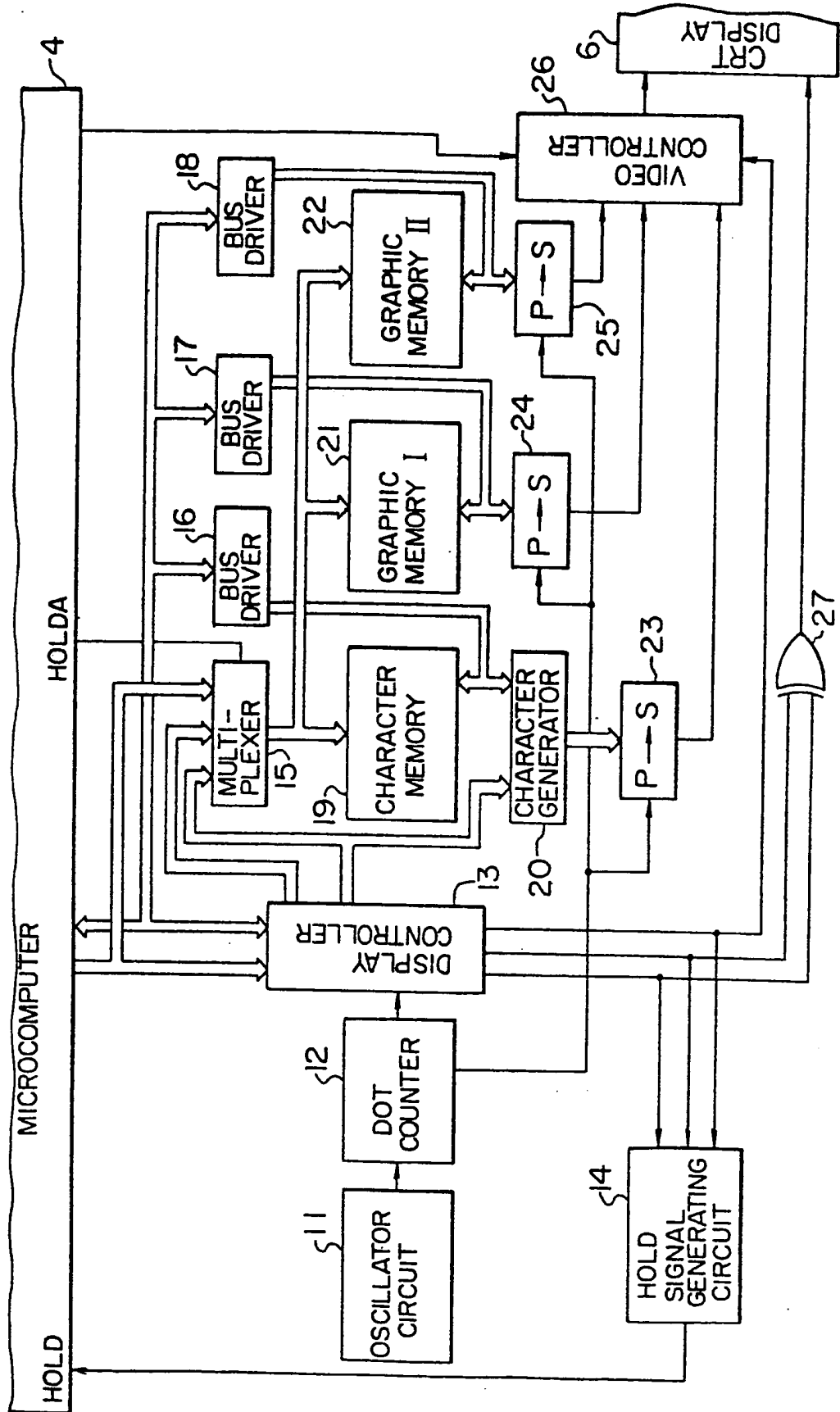


FIG. 2



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FIG. 3

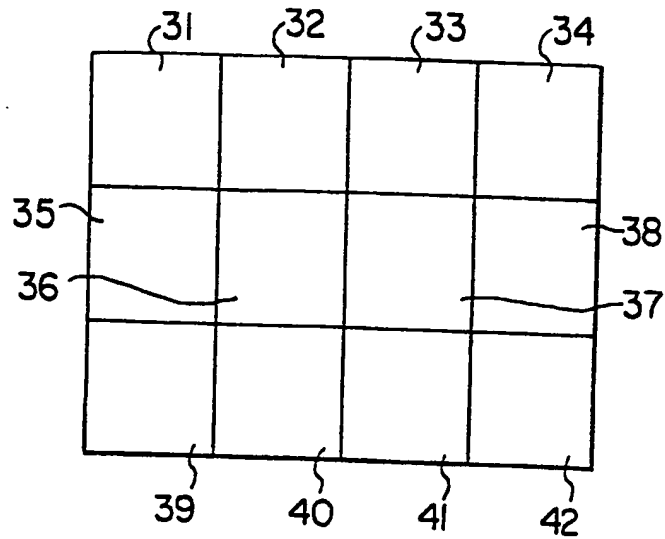


FIG. 4

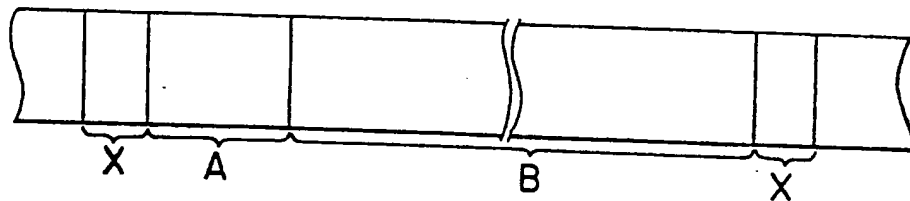


FIG. 5

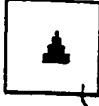
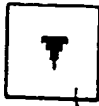
SELECT MAP			
DISTRICT	DIVISION	SECTION	
0	2	—	4 — 6 8
		S	R
51	52	53	54

FIG. 6

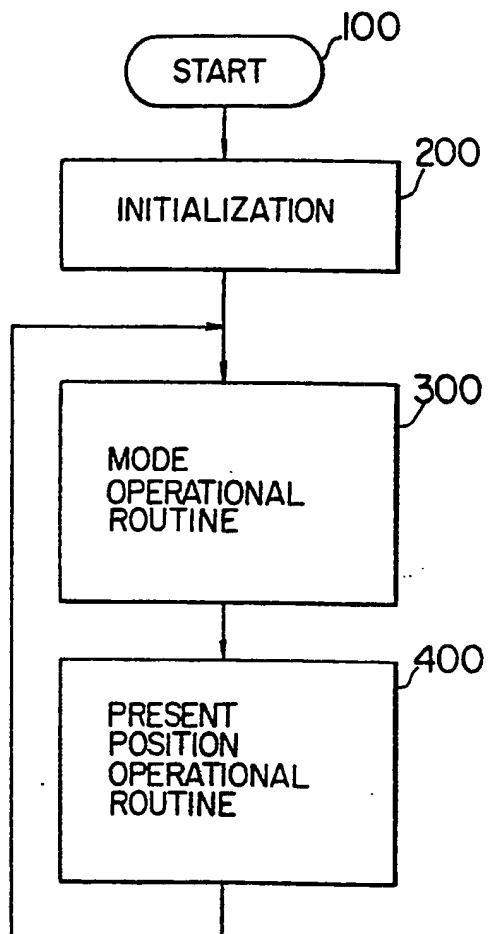


FIG. 7

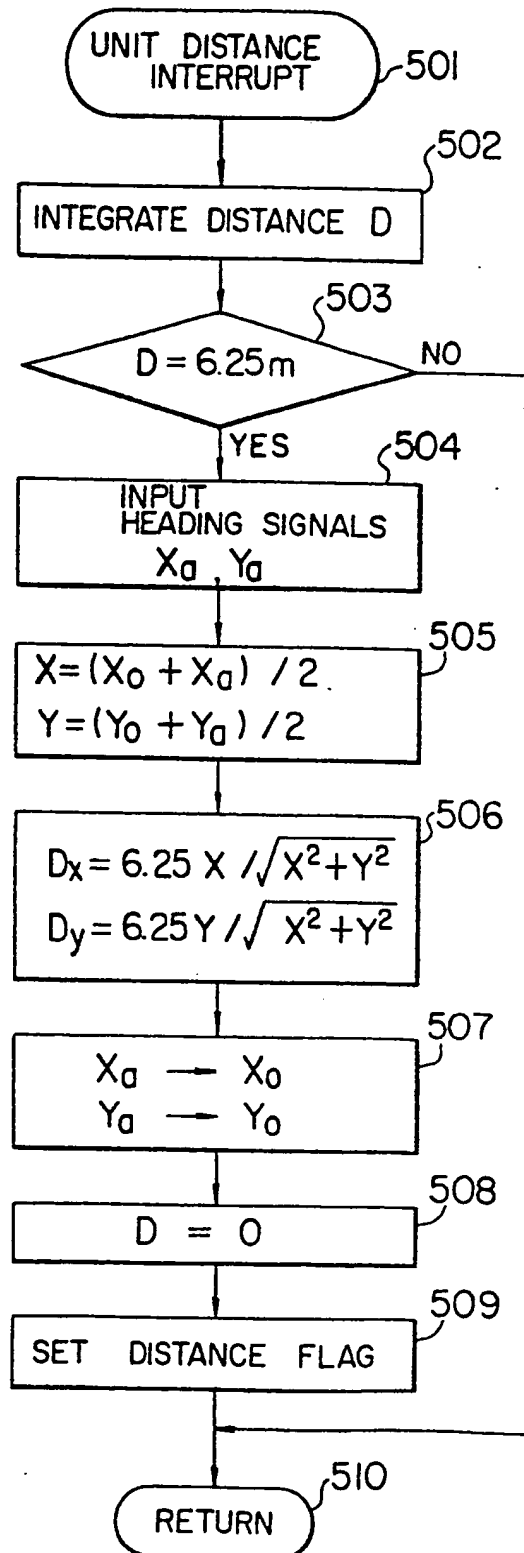


FIG. 8

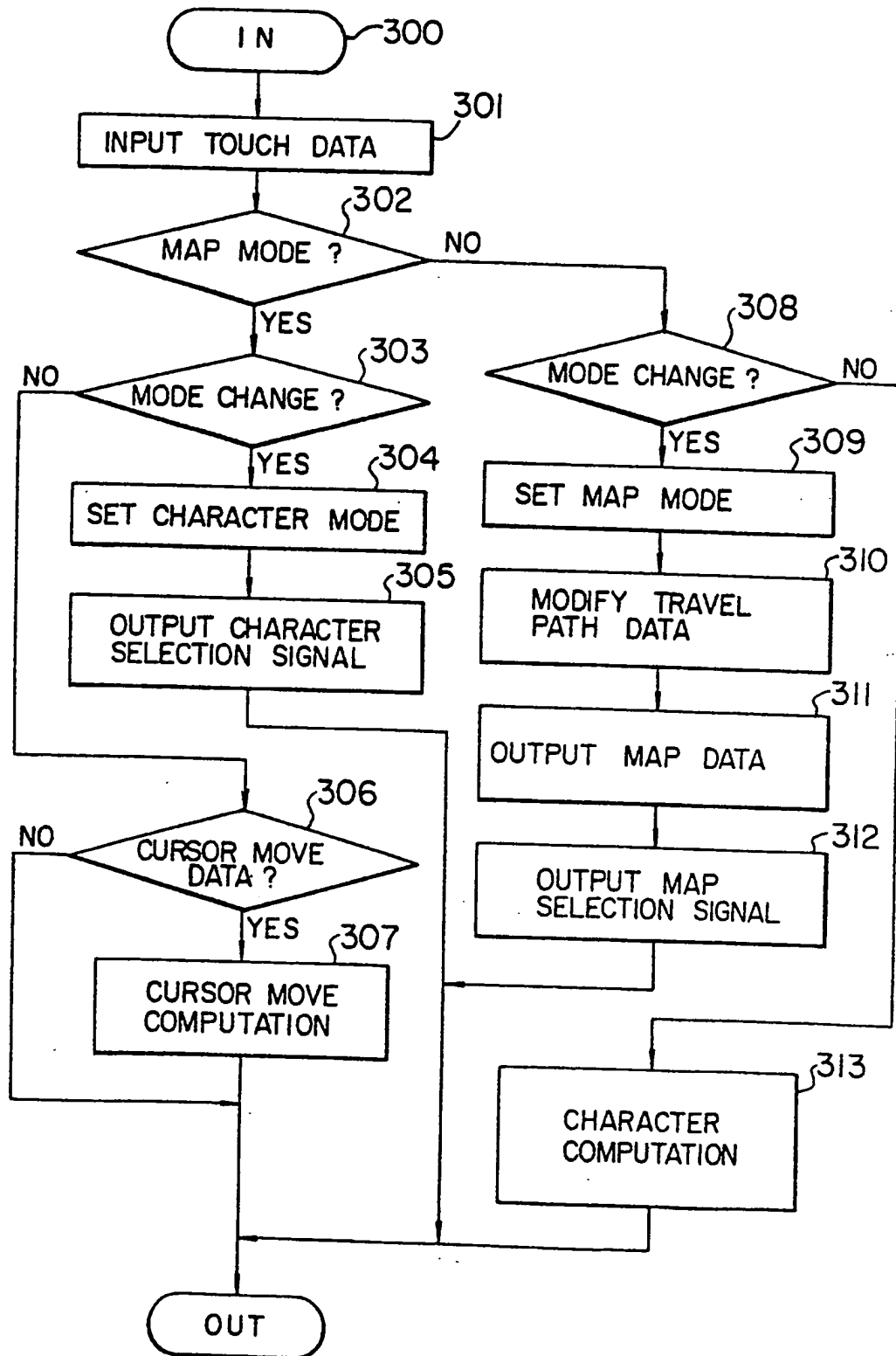
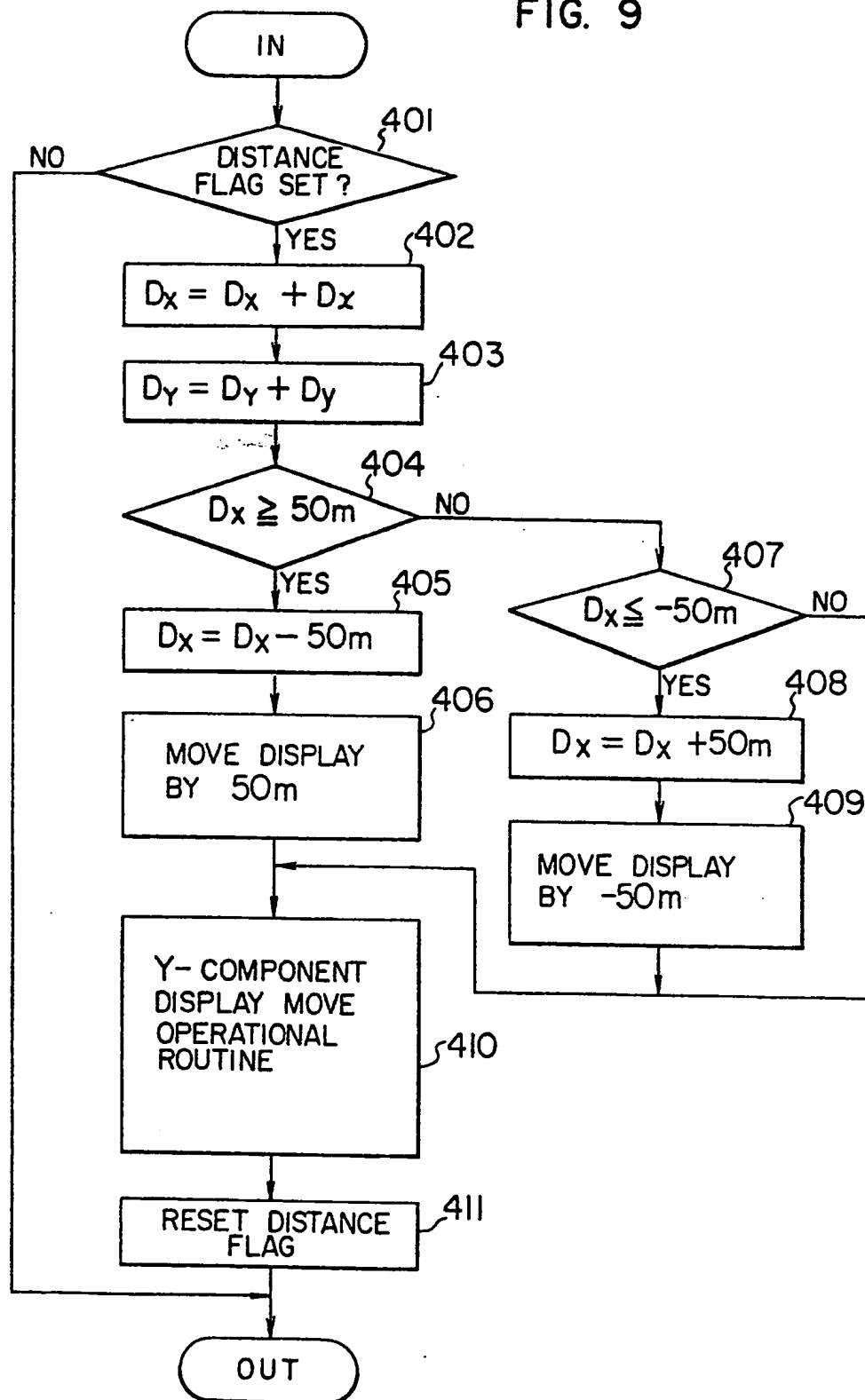


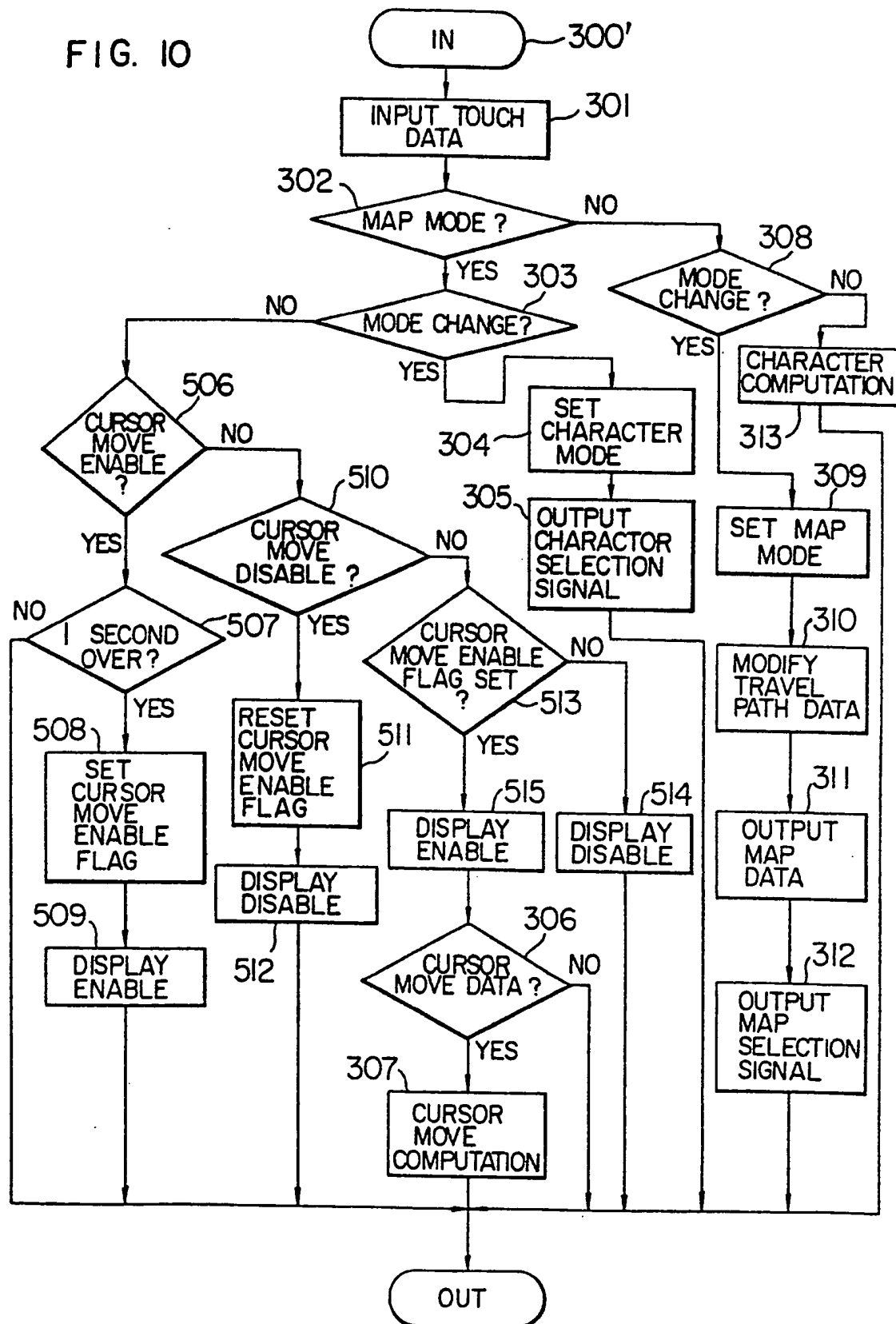
FIG. 9





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FIG. 10



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FIG. 11

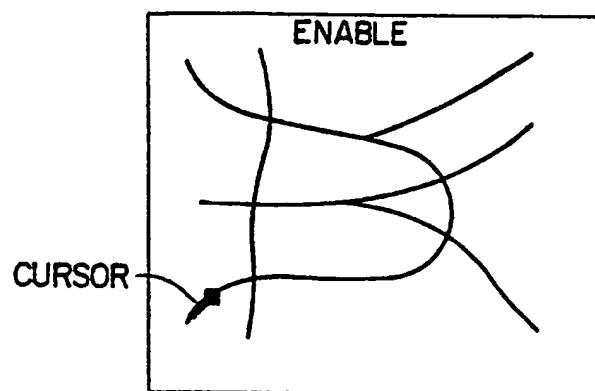
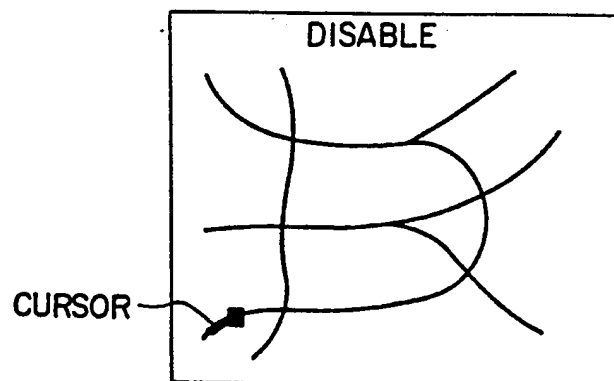


FIG. 12



0066397



European Patent  
Office

## EUROPEAN SEARCH REPORT

Application number

EP 82 30 2475

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y	US-A-4 086 632 (R.O.LIONS) *Column 1, lines 25-45; column 3, line 10 - column 4, line 14; figure 1*	1,3-6	G 01 C 21/20 G 06 F 15/50
Y	FR-A-2 371 723 (LAPY V.J et al.) *Page 2, line 26 - page 4, line 10; figure 1*	1,2	
A	DE-A-2 910 386 (TELDIX) *Page 6, paragraph 2 - page 7, line 12*	1,2	
A	US-A-4 139 889 (G.W.INGELS) *Column 2, line 25 - column 3, line 8; column 7, lines 23-51; figures 2,5*	1,2	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			B 60 K 35/00 G 01 C 21/00 G 06 F 15/00 G 07 C 5/00 G 08 C 21/00
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10-08-1982	Examiner PRATSCH H.R.
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			